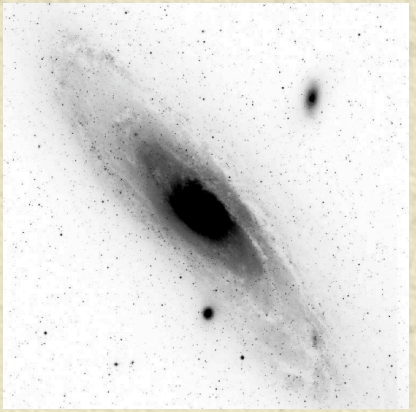
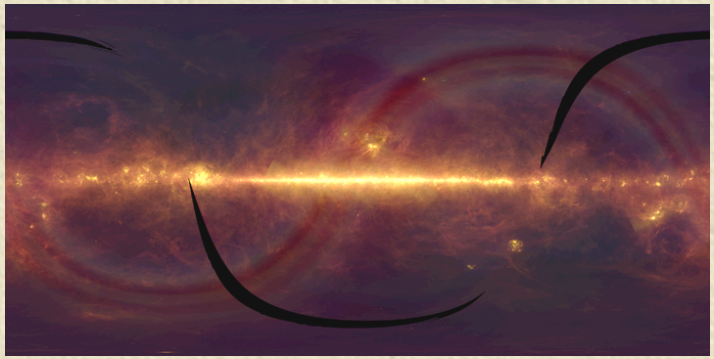
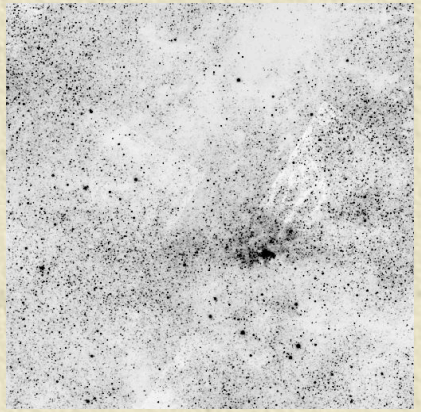
Toward the National Virtual Observatory

http://yourSky.jpl.nasa.gov







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Jet Propulsion Laboratory
California Institute of Technology

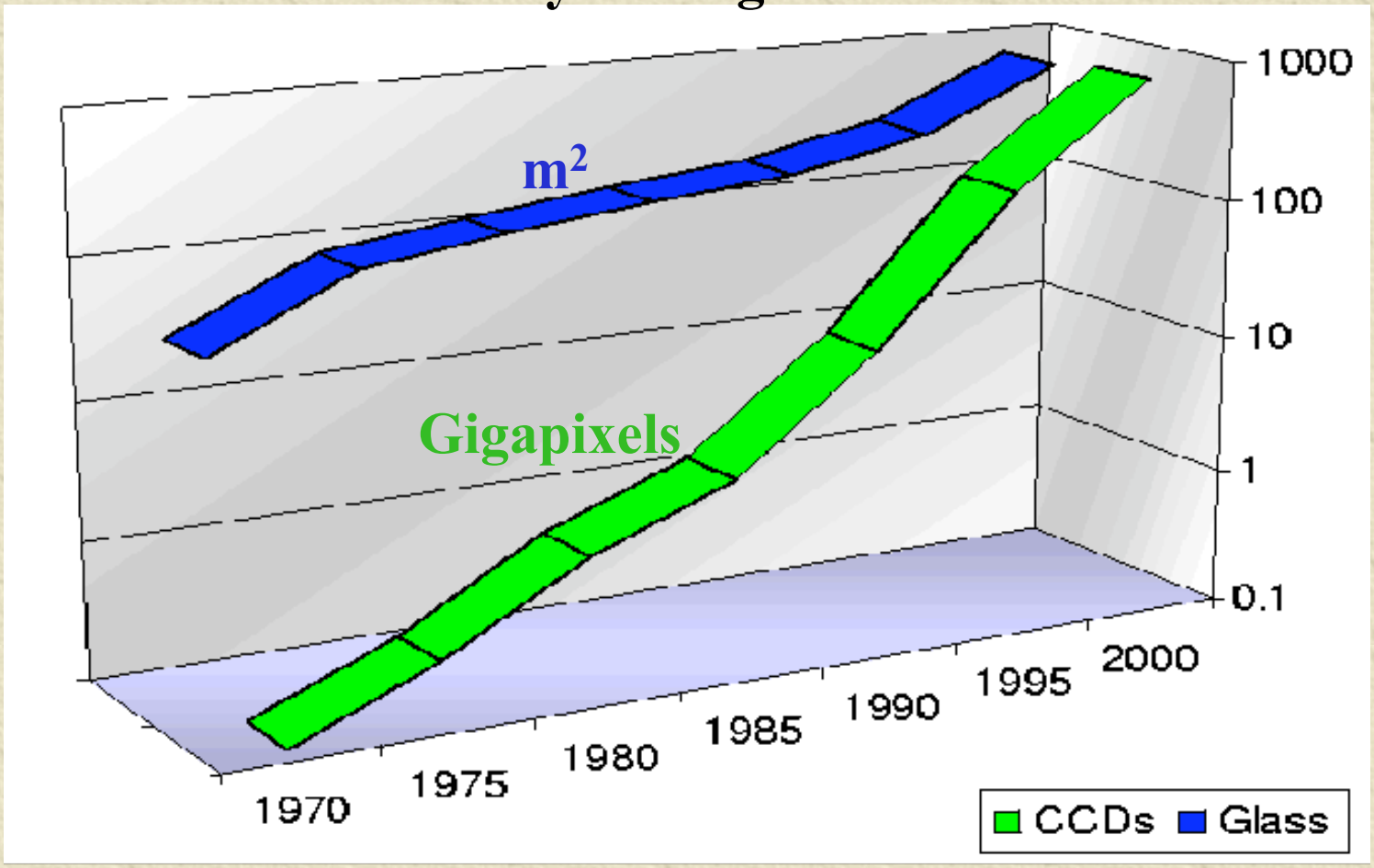
JPL IT Symposium 2002
November 4, 2002

Outline

- Motivation
- Virtual Observatories
- yourSky (http://yourSky.jpl.nasa.gov)
  - User Perspective
  - Behind the Scenes
  - Graphical Front-End
- Follow-on Activities

The Data Avalanche!

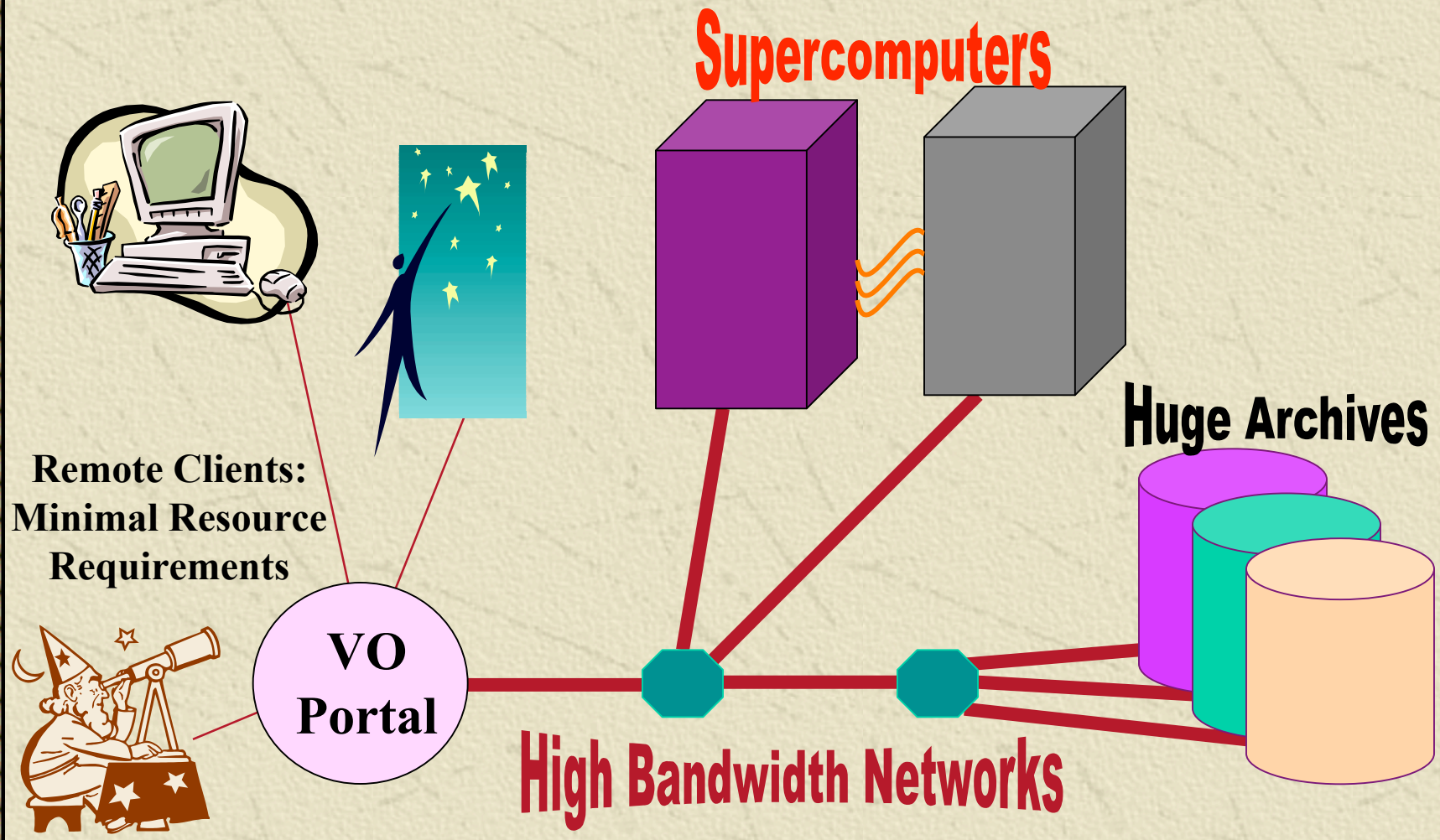
Growth in Aperture & Focal Plane
Of Institutionally Managed Observatories



Virtual Observatories

- Community driven.
- Community built.
- Community access.
- Emphasis on many interoperable components developed and deployed by domain experts in different areas.
- Highly distributed, including centers for:
  - Archive
  - Processing
  - Visualization
- Exploit high performance computation and communications assets.

Transparent Use of High Performance Infrastructure

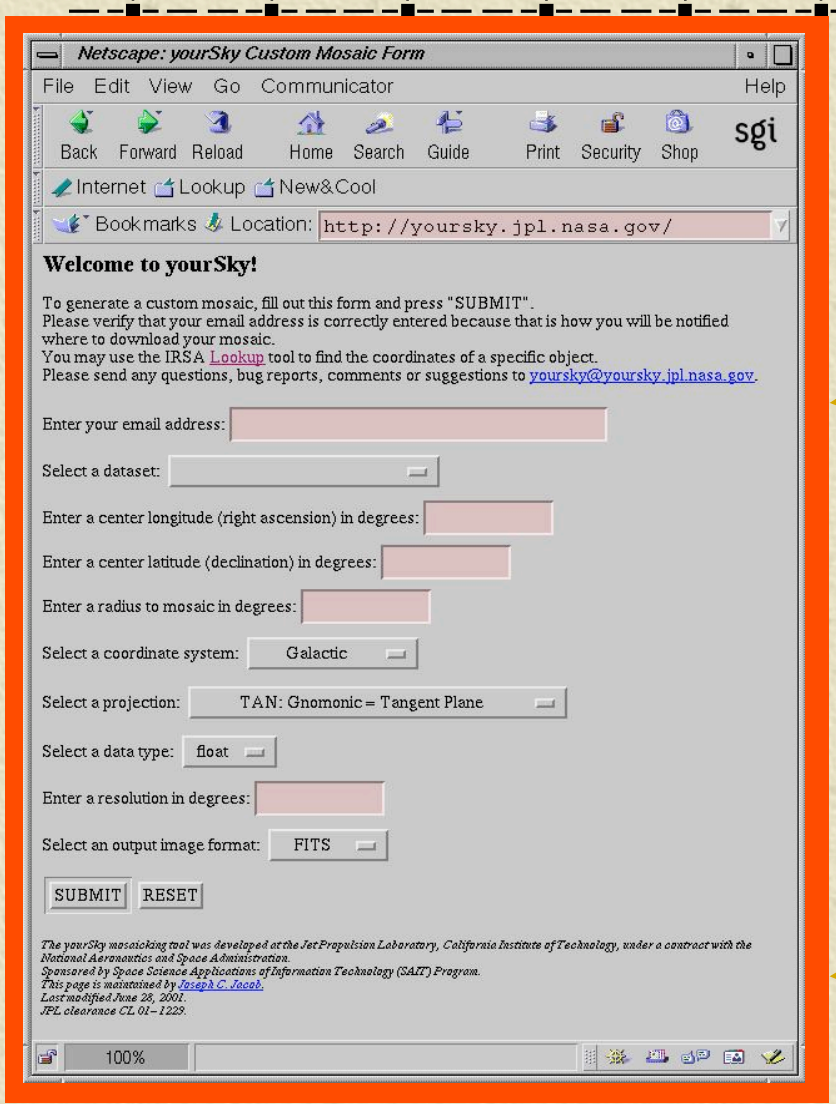


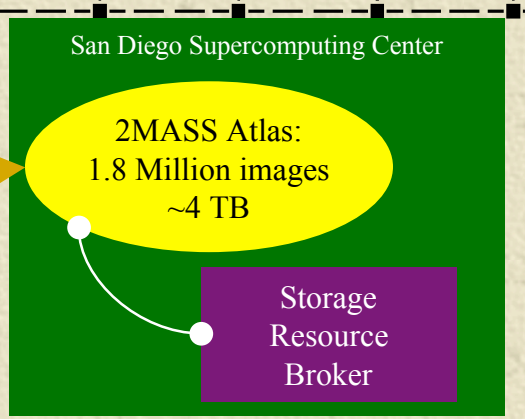
Example: Custom 'On-the fly' Mosaic Portal

- **"Provide custom access to a compute-intensive, scalable interoperable service that delivers science-grade image mosaics to user's desktops, through existing portals."**
- Custom access = user specifies dataset, location, size, resolution, coordinate system, projection, data type, and image format.
  - Architecture invites growth to expand options for custom image processing – multiple background removal techniques, overlap blending recipes, multiple surveys, etc.

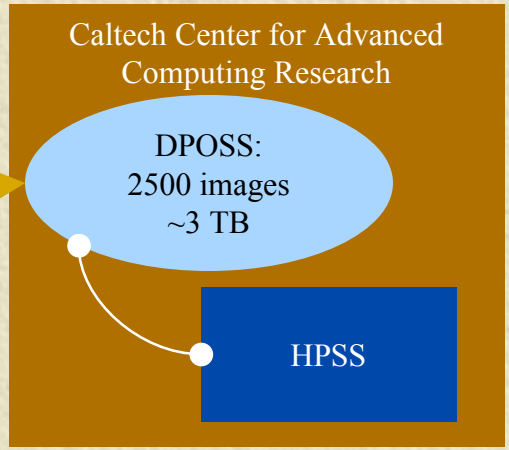
yourSky Custom Mosaic Portal

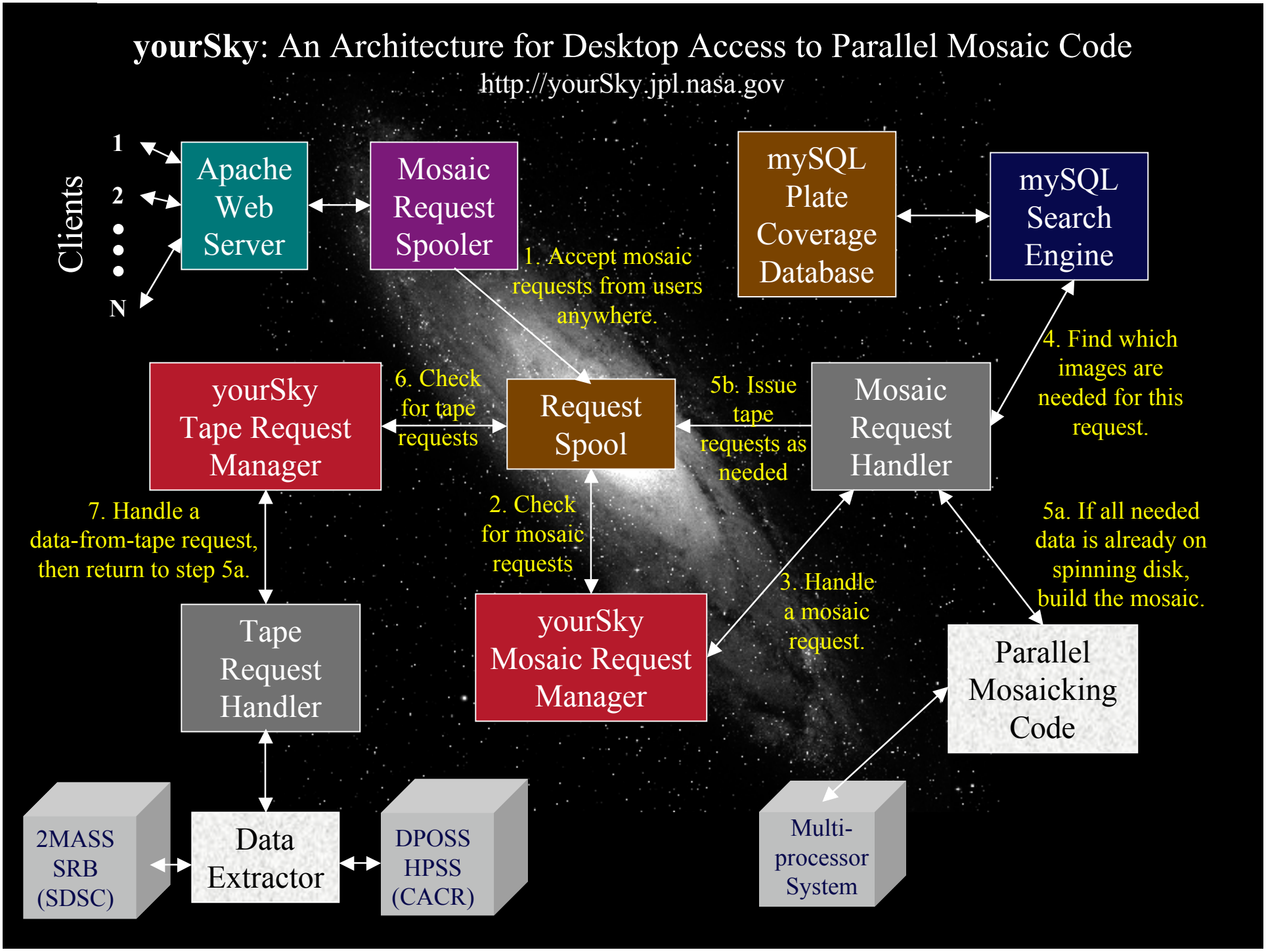
http://yourSky.jpl.nasa.gov

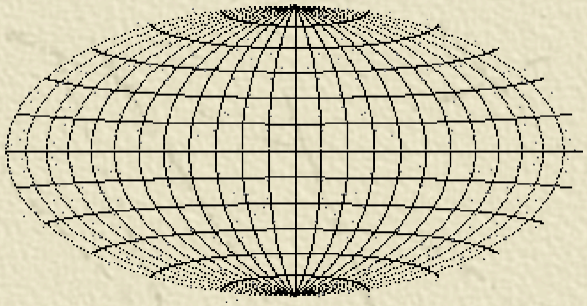




yourSky can access all of the publicly released DPOSS and 2MASS images for custom mosaic construction.

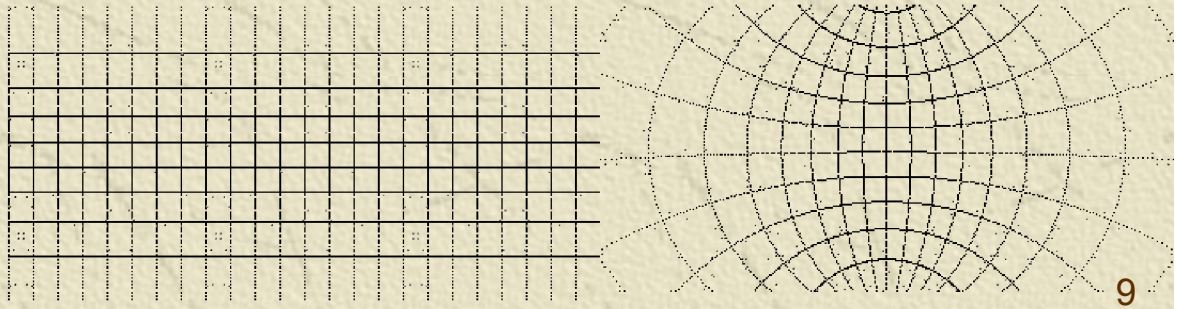



yourSky: An Architecture for Desktop Access to Parallel Mosaic Code
http://yourSky.jpl.nasa.gov
Clients
1
2
N
Apache Web Server
Mosaic Request Spooler
1. Accept mosaic requests from users anywhere.
mySQL Plate Coverage Database
mySQL Search Engine
4. Find which images are needed for this request.
yourSky Tape Request Manager
6. Check for tape requests
Request Spool
5b. Issue tape requests as needed
Mosaic Request Handler
7. Handle a data-from-tape request, then return to step 5a.
2. Check for mosaic requests
5a. If all needed data is already on spinning disk, build the mosaic.
3. Handle a mosaic request.
Tape Request Handler
yourSky Mosaic Request Manager
Parallel Mosaicking Code
2MASS SRB (SDSC)
Data Extractor
DPOSS HPSS (CACR)
Multi-processor System



Custom Coordinate System and Projection

- Coordinate Systems: Galactic, Ecliptic, J2000 Equatorial, B1950 Equatorial.
- WCS projections: LIN, TAN, SIN, STG, AZP, ARC, ZPN, ZEA, AIR, CYP, CAR, MER, CEA, COP, COD, COE, COO, BON, PCO, SFL, PAR, AIT, MOL, CSC, TSC, DSS, PLT.



Custom Image Format and Data Type

Image Format:

- FITS
- JPEG
- PGM
- PNG
- TIFF
- Raw Data

Data Type:

- 8-bit unsigned integer
- 8-bit signed integer
- 16-bit unsigned integer
- 16-bit signed integer
- 32-bit unsigned integer
- 32-bit signed integer
- Single precision floating point
- Double precision floating point

Graphical Front-End to yourSky
Web-Based Pan/Zoom Engine

- **All-sky browsing at medium resolution.**
- **Efficient Navigation:** Either click to re-center or zoom or enter Right Ascension (longitude), Declination (latitude) and a zoom level to jump to the desired view.
- **Multi-Spectral Viewing:** View gray scale image or map any member dataset to red, green, or blue for a color image.
- **Catalog Overlays:** Plot catalog objects overlaid on top of the image.
- **Integrated with yourSky mosaic engine:** Click a link to submit a yourSky mosaic request for the current view.

Graphical Front-End to yourSky

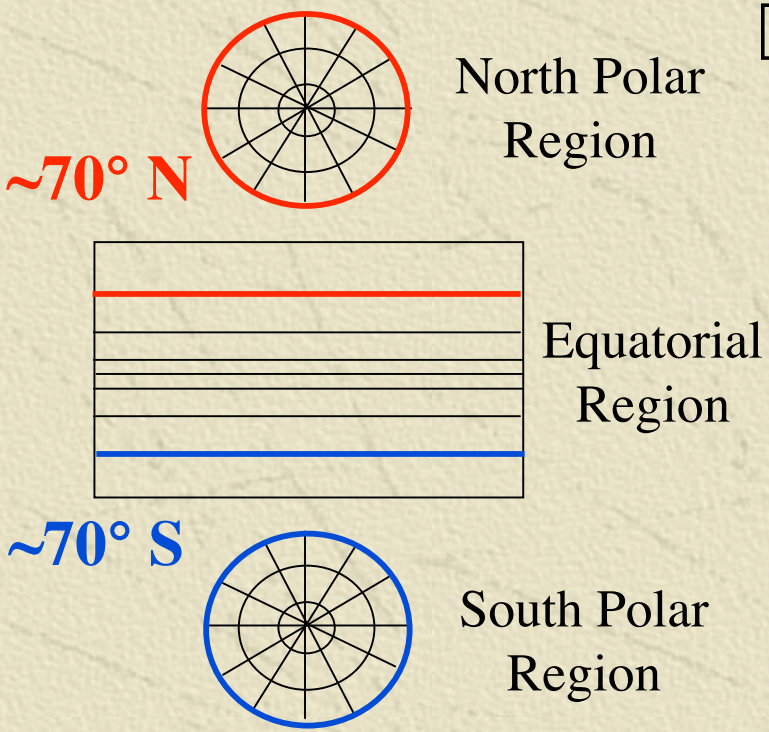
Status

- All sky 1/8 resolution 2MASS and DPOSS mosaics completed:
  - Multiple overlapping plates constructed to minimize distortion no matter where you look.
  - Plate locations determined by HTM vertices (HTM is Hierarchical Triangular Mesh, specified by A. Szalay, JHU under AISRP funding).
  - Nearly 10^{12} DPOSS and 2MASS pixels reprojected on 64 processor Origin 2000!
- To finish up we will build a "resolution pyramid" -- all sky coverage at successively coarser zoom levels to facilitate zoom functionality.
- Expect the graphical front-end to be accessible at http://yourSky.jpl.nasa.gov by November 15.

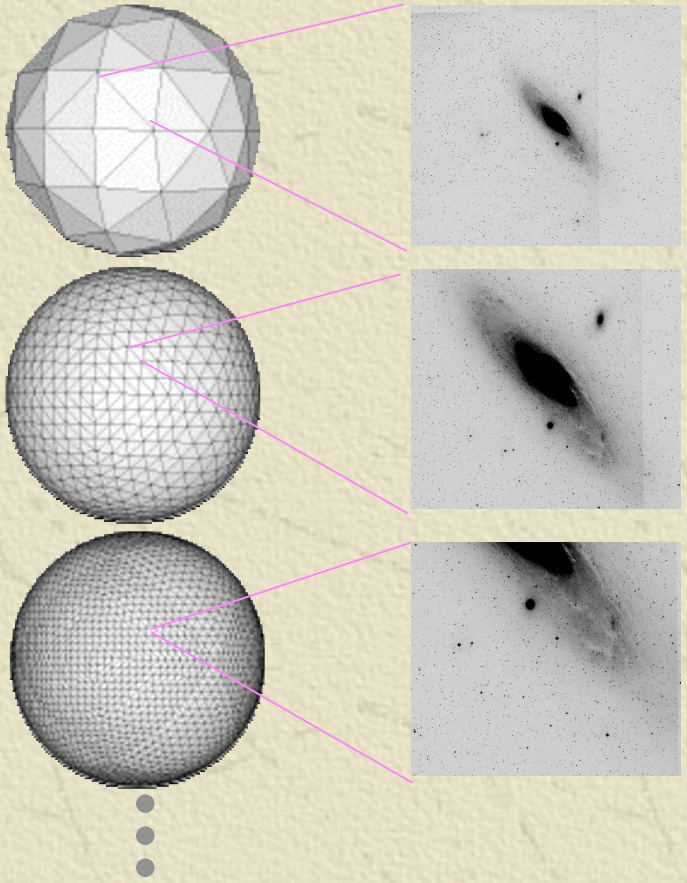
Graphical Front-End to yourSky

Architecture

Synoptic View

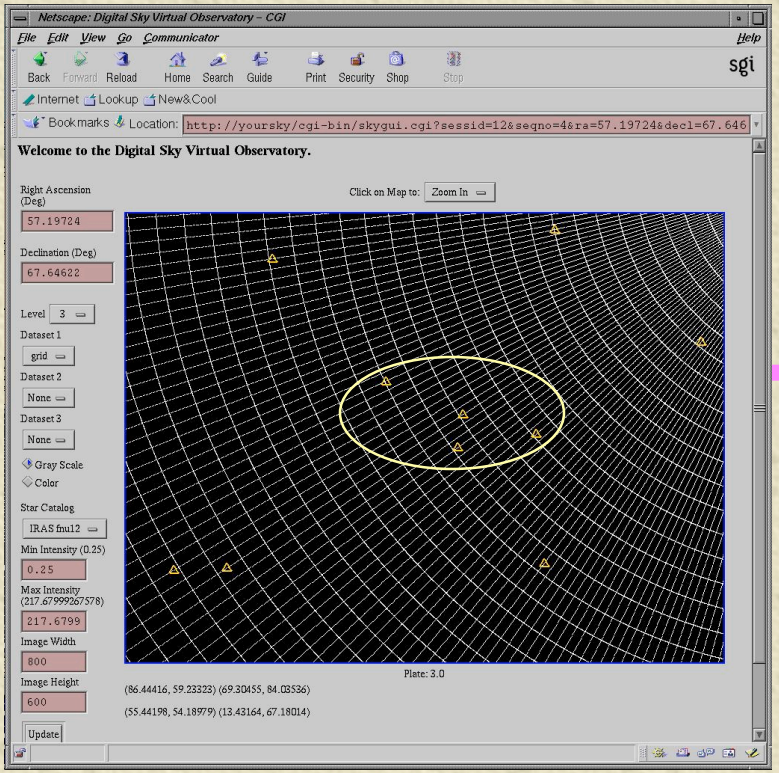


- Hierarchical Triangular Mesh
- Single tangent plane at each vertex.

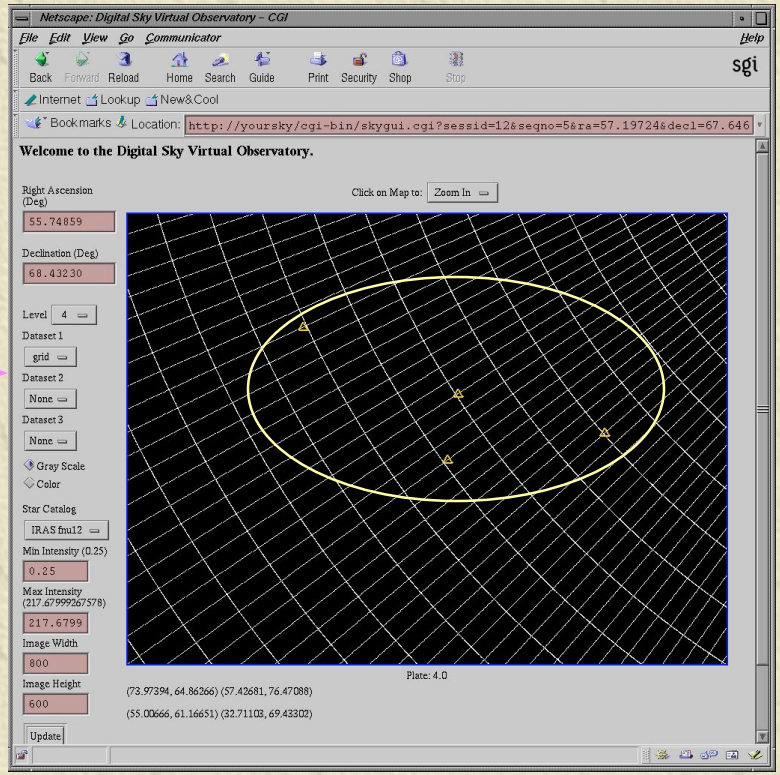


Graphical Front-End to yourSky

Catalog Overlays

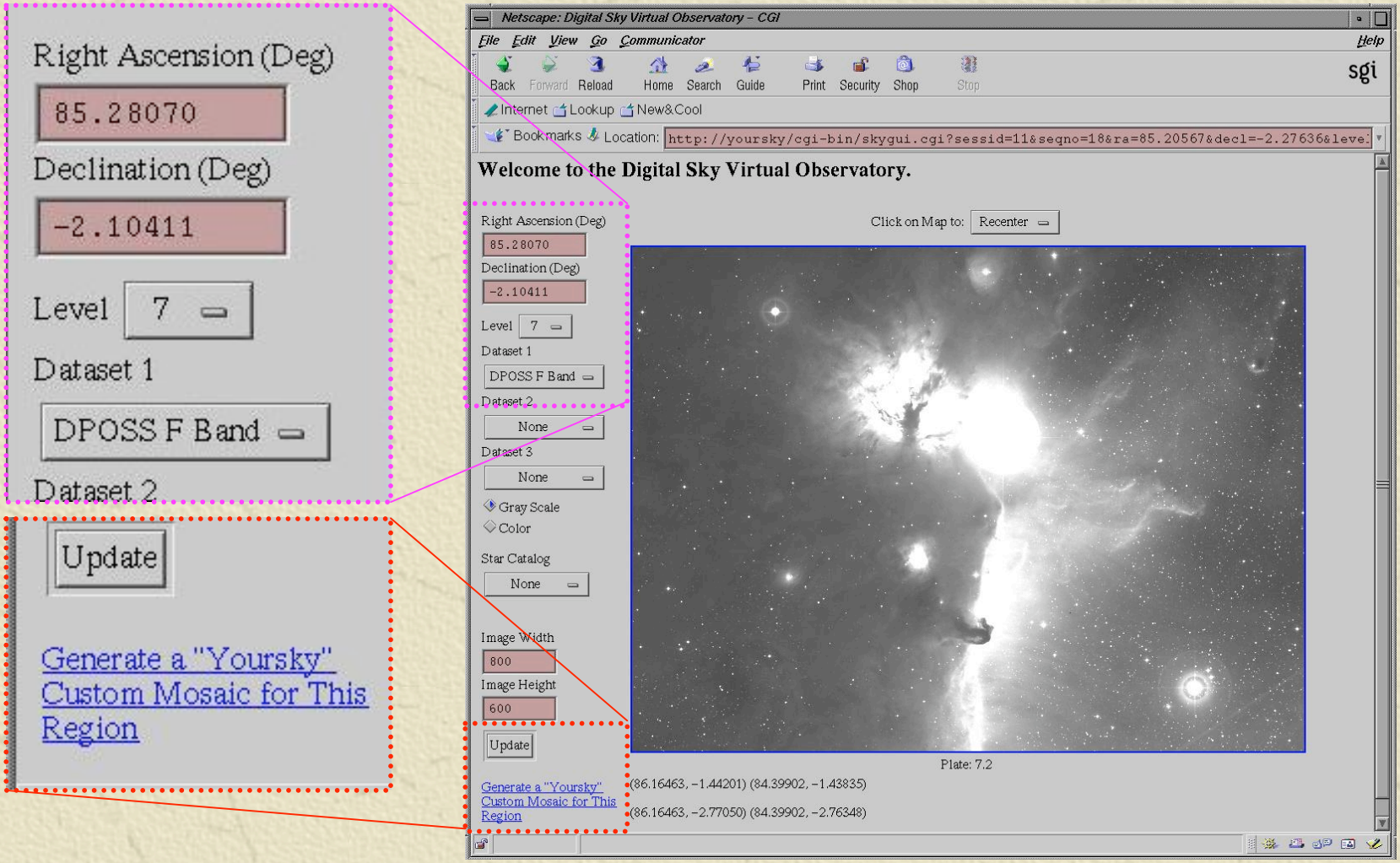


Zoom



Graphical Front-End to yourSky

Sample Screen Capture



Follow-on Activities

Montage:

- yourSky is the baseline code for Montage, an ESTO-CT Round 3 Grand Challenge Project (P.I.: T. Prince).
- Collaboration between CACR, IPAC and JPL.
- Montage will improve upon yourSky:
  - **Science Quality** – Flux preservation / Background matching.
  - **Performance** – Throughput
  - **Interoperability** with NVO infrastructure.
  - **Interoperability** with TeraGrid and Information Power Grid infrastructure.
- Montage has staged code improvement deliverables through January, 2005.

Follow-on Activities (cont.)

Information Power Grid

- NASA's computational grid infrastructure.
- Globus enabled version of yourSky.
- Launch yourSky mosaicking code on the Grid instead of on local machine.
- Dramatic improvements in the size and number of mosaic requests we can handle.
- Use power of the Grid to extend browse capability to full 1 arcsec resolution.

Summary

- yourSky supports large scale data access and image mosaicking on supercomputers.
- yourSky places minimal computing requirements on the users: Web browser.
- Requests to yourSky can be made using a simple form interface, or assisted by the graphical front-end (web-based pan/zoom).
- http://yourSky.jpl.nasa.gov
- Questions?

JPL